OpenCUDA + MPI

A Framework for Heterogeneous GP-GPU Distributed Computing

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Introduction

Parallel and Distributed Computing

What is GP-GPU Distributed Computing?

- Parallel:
  - Processing concurrently
- Distributed:
  - Processing over many computers, typically in parallel, but not always
  - Local
  - Grid Computing

Applications of Supercomputing

What can we do with Parallel and Distributed Computing?

- Solving (Large) Linear Systems
  - LINPACK Benchmarks
- Fluid Dynamic Simulations
- N-Body Simulations
- Brute-Force Password/Hash Cracking
- Prime Number Searching
- Protein Folding
- Image Analysis / Manipulation
- ...

Who Uses Distributed Computing?

- Google – Page Indexing
  - Created Map-Reduce
- Facebook – Data Mining
- Universities
- Many Others

The Problem(s)

- "Distributed Programming" is expensive
- Specificity of Hardware
- Data
  - Distribution
  - Volume
- Fault Tolerance

A Framework

Solutions

- Ease Programming Interface for Highly Parallel Distributed Computing
- Allow for Diversity in Computing Environment
  - Bring together ideas from both types of distributed computing
  - "Jungle Computing"

Plan and Goals

- Develop a framework for distributed computing over a heterogeneous cluster
- Develop several different solutions for vascular extraction from CT angiography scans
- Profile the different solutions
- Add Cluster/ Node Configuration and Scheduling Options

Progress

Progressing more slowly than I anticipated

- CUDA C/C++ and `pyCUDA`
- Cluster/ Node Administration (ongoing)
- `mpi4py` – Begin learning the MPI interface and intricacies

Continuing Progress

- Continue Learning `mpi4py` and `pyCUDA`
- Combine `mpi4py` with `pyCUDA`
- ...
- Begin developing framework

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Questions?